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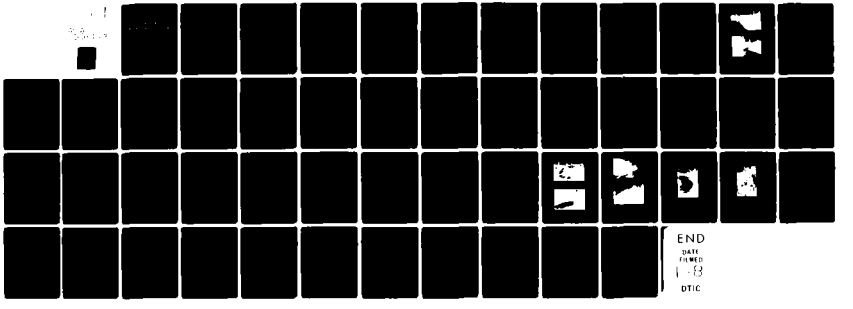

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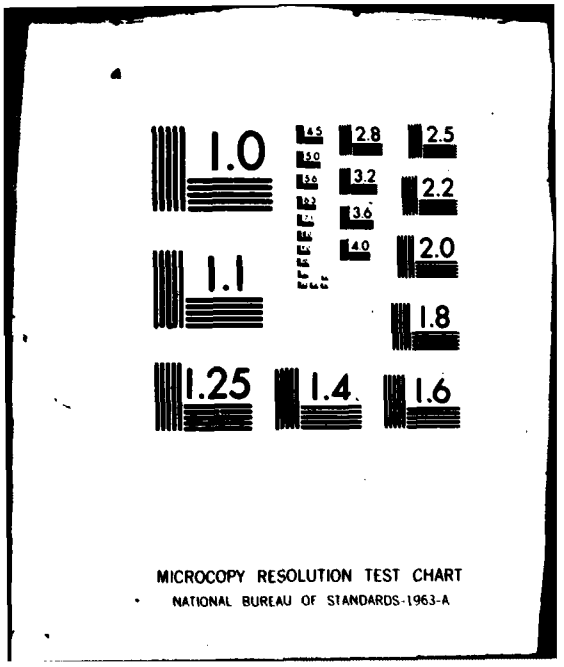
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ROANOKE RIVER BASIN

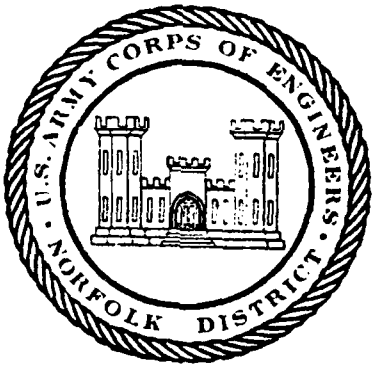
Name Of Dam: TIMBER LAKE DAM

Location: CAMPBELL COUNTY, VIRGINIA

Inventory Number: VA. NO. 03102

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

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J. K. TIMMONS AND ASSOCIATES, INC.

JULY 1980

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

ROANOKE RIVER BASIN

NAME OF DAM: TIMBER LAKE DAM
LOCATION: CAMPBELL COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 03102

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

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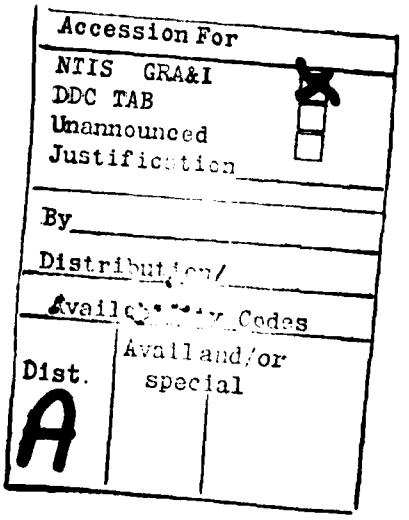

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Name of Dam: Timber Lake Dam
State: Virginia
County: Campbell
USGS Quad Sheet: Forest
Coordinates: Lat 37° 18.8' Long 79° 15.5'
Stream: Buffalo Creek
Date of Inspection: April 17, 1980

BRIEF ASSESSMENT OF DAM

Timber Lake Dam is a homogeneous earthfill structure about 600 ft long and 33 ft high. The principal spillway consists of a 6 ft high by 25 ft wide arch bridge with a bottom elevation of 814 msl. The structure is classified intermediate in size and is assigned a significant hazard classification. The dam is located on Buffalo Creek about 6 miles southwest of Lynchburg, Virginia. The reservoir is used for recreational purposes and is owned and maintained by the Peaks View Corporation.

Based on criteria established by the Department of Army, Office of the Chief of Engineers (OCE), the appropriate Spillway Design Flood (SDF) is the ½ PMF. The spillway will pass 20 percent of the Probable Maximum Flood (PMF) or 40 percent of the SDF. During the SDF, the dam will be overtopped to a depth of 2.8 ft maximum, at a maximum velocity of 7.1 fps, and will be overtopped for a period of 5.0 hours. Overtopping is considered detrimental.

An evaluation of the stability condition could not be made since there is no design or construction data for this structure. The visual inspection revealed the presence of seepage at the base of the downstream toe which is believed to be draining through the

existing rock toe.

Due to the inadequacy of the spillway, the detrimental effect of the resulting overtopping during the SDF, and the lack of stability data, the potential for increased hazard to the downstream dwellings exists, and the dam is assessed "unsafe non-emergency".

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

It is therefore recommended that within two months of the date of notification of the Governor of the Commonwealth of Virginia, the Owner engage the services of a professional engineering consultant to perform necessary studies and design work outlined below:

1) A detailed evaluation of the downstream floodplain and of the Spillway Design Flood appropriate to this dam. Remedial measures to be considered include modification to the dam, spillway, floodplain, and/or any other method of eliminating the danger imposed by the dam.

2) A subsurface investigation and stability analysis should be performed by a Geotechnical Engineer in order to evaluate the stability of the dam and modify as necessary.

Within six months of the notification of the Governor, the consultant's analyses and recommendations should be completed and the Owner should have an agreement with the Commonwealth of Virginia for a reasonable time period in which all remedial measures will be complete. In the interim, an emergency operation and warning plan should be developed.

The following routine maintenance and observation functions should be initiated:

1) The concrete spillway discharge channel should be repaired.

2) The eroded left abutment slope which bounds the plunge pool area presents a potentially unsafe condition for any persons in the immediate area. Efforts should be made to either restrict human activity in this area or to stabilize the slope.

3) The iron-stained seepage observed along the downstream slope should be monitored quarterly and during periods of high pool levels to detect any increase in flow rates which may cause piping within the embankment or foundation soils.

4) Vegetation should be routinely controlled. The slopes and crest of the structure and the emergency spillway should be mowed twice per year and all existing trees cut to the ground. Trees greater than 3 inches should have their stumps and root structures removed with resulting holes backfilled with compacted soil and seeded.

5) A staff gage should be installed to monitor water levels.

Prepared by:

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS & ASSOCIATES, INC.

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Colonel, Corps of Engineers
District Engineer

Recommended by:

Original signed by:
JOHN R. PHILPOTT
for Jack G. Starr, P.E., R.A.
Chief, Engineering Division

Date: AUG 15 1980

Upstream Face

Roadway Across Dam

OVERVIEW PHOTOGRAPHS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
TIMBER LAKE DAM
VA. NO. 03102

SECTION I - PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (See Reference 1, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Timber Lake Dam is a homogeneous earthfill structure approximately 600 ft long and 33 ft high.* The top of the dam is 17 ft wide and is at elevation 820 ft msl. Side slopes are approximately 2 horizontal to 1 vertical (2:1) on the downstream side and appear very steep on the upstream side above the pool level. The upstream slope is reported to be 3 horizontal to 1 vertical (3:1).

* Height is measured from the top of the dam to the downstream toe at center line of the stream.

There is a concrete wall which varies in height from 5 to 6 ft along the upstream face of the dam above the normal pool. The top of the dam serves as part of the roadway system for the subdivision, and is paved for a width of 15 ft.

A concrete core of unknown dimension was constructed for this structure, however the existence of a cutoff could not be confirmed. It is not known whether there is an internal drainage system, but there is a rock toe drain. Existing vegetation on the embankment slopes provide adequate slope protection.

The principal spillway consists of a 6 ft high x 25 ft wide reinforced concrete arch bridge with a bottom elevation of 814 msl. The arch bridge is located at the left abutment and is connected to the lake by a 25 ft wide approach channel. A 12 inch diameter drain located at the center of the dam is used to drain the lake (See Plate No. 2, Appendix I).

1.2.2 Location: Timber Lake Dam is located on Buffalo Creek, 6 miles southwest of Lynchburg, Virginia (Plate No. 1, Appendix I).

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of the maximum storage capacity.

1.2.4 Hazard Classification: The dam is located in a suburban, forested area, and based upon the downstream proximity of several homes located one-half to one mile downstream, the dam is assigned a "significant" hazard classification. The hazard classification used to categorize a dam is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: Peaks View Corporation, Lynchburg, Virginia, owns and operates the dam.

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was designed and constructed under the direction of Mr. E. Craighill and completed in 1924 or 1925. Mr. F. L. Showalter, Sr., a partner of Mr. Craighill's, was able to provide some information concerning the history of the structure.

1.2.8 Normal Operational Procedures: The principal spillway is ungated, therefore, water rising above the weir crest at the arch bridge automatically is discharged downstream. Normal pool is maintained at elevation 814 msl.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The drainage area is 4.36 square miles.

1.3.2 Discharge at Dam Site: Maximum known flood at the dam site occurred in 1927, when a pool level approximately one foot below the dam crest was observed.

Principal Spillway Discharges:

Pool Elevation at Crest of Dam (elev 820 msl) 3145 CFS

1.3.3 Dam and Reservoir Data: See Table 1.1, below:

TABLE 1.1 - DAM AND RESERVOIR DATA

Item	Elevation Feet msl	Reservoir Storage Area Acres	Reservoir Storage Volume Acre Feet	Watershed Inches	Length Miles
Crest of Dam	820	93	1449	6.23	.75
Principal Spillway Crest	814	60	990	4.26	.70
Streambed at Downstream Toe of Dam	787	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: There is no design data available. The dam was designed by E. Craighill (deceased) of Lynchburg, Virginia.

2.2 Construction: No construction records are available. Mr. F. L. Showalter, Sr., former partner of Mr. Craighill's, was able to provide some information concerning construction of the dam. The dam was constructed under their supervision and completed around 1924 or 1925. It was constructed as a homogeneous structure with "red clay all the way". A small concrete core was also included, however, its dimensions are not known. Embankment slopes were 2 horizontal to 1 vertical on the downstream side and 3 horizontal to 1 vertical on the upstream side, which according to Mr. Showalter were typical design slopes at that time. The fill was placed and compacted with mules and "slip scrapers". Mr. Showalter said the rock toe drain and concrete wall (upstream slope) were not included in the original design and must have been constructed at a later date. No springs were believed encountered during construction of the dam.

2.3 Evaluation: Engineering calculations are not available and there are no records available for dam performance. There is insufficient information to evaluate the foundation conditions and the embankment stability.

SECTION 3 - VISUAL INSPECTION

3.1 Findings: At the time of inspection, the dam was in fair condition. Field observations are outlined in Appendix III.

3.1.1 General: An inspection was made 17 April 1980 and the weather was clear with a temperature of 55° F. The pool and tailwater levels at the time of inspection were 814 and 787 msl, respectively which correspond to normal levels. Ground conditions were damp at the time of the inspection. No previous inspection reports were available.

3.1.2 Dam and Spillway: The embankment slopes and much of the abutment areas were overgrown with trees of various diameter, dense weeds and brush. This extremely thick vegetative cover hindered the visual inspection. Consequently, sloughing and erosion of the embankment were not observed. A paved road occupies the crest of the dam. The upstream slope which is reported to be 3H:1V, appeared to be nearly vertical and inculded a 5 to 6 ft high concrete wall. Riprap was observed below pool level along the toe of this wall. A benched rock toe drain was encountered along the downstream slope. See field sketch, Sheets No. 1 and 2, Appendix III.

Scattered seepage areas were located below the toe drain. The seepage was iron-stained and was seeping at a rate of no more than 1 gpm. The ground surface below the toe drain was generally saturated to a point 50 ft below the drain (See Sheet 1, Appendix III). It would appear that the toe drain is functioning properly. A small spring

was also observed along the right side of the drain outfall channel, 10 ft from the end of the pipe. Flow was estimated at 5 gpm (see Sheet 2, Appendix III).

The right abutment is heavily overgrown with vegetation, making observation difficult. Gray to brown highly weathered to decomposed mica schist is exposed in the severely eroded principal spillway outfall channel at the left abutment. A vertical drop of about 30 ft exists at the contact of the abutment and principal spillway outfall as a result of erosion. Foliation or "slaty cleavage" strikes to the northeast and dips from vertical to 45 degrees^{+} to the southeast. Joint sets were also observed in the rock and about 30 ft of residual soils were exposed above the bedrock. These soils are highly micaceous and visually classify as SM, ML and MH. No faults were observed in the field during the inspection and geologic maps of the area do not show the presence of faults in the immediate vicinity.

The arch bridge and approach channel showed no signs of deterioration. The concrete in the discharge channel was cracked, with a large stream of water entering from the left side, and the end section was broken allowing water to fall approximately 25 ft into a pool area without any erosion control measures, (see Photo No. 1, Appendix II). The left slope of plunge pool area was badly eroded.

3.1.3 Reservoir Area: The reservoir area was free of debris and the perimeter was gravel. The reservoir is located in a valley with side slopes at approximately 20H:1V. Some sediment was detected in the approach channel. The lake water was very murky.

3.1.4 Downstream Area: The downstream channel consists of a 6 ft wide by 2 ft deep channel located in a 300 ft wide flood plain. The valley side slopes range from 2H:1V to 4H:1V and were heavily wooded. Approximately one-half to 1 mile downstream there are homes about 15 ft above the streambed.

3.1.5 Instrumentation: No instrumentation (monuments, observation wells, piezometers, etc.) was encountered for the structure. A staff gage does not exist.

3.2 Evaluation:

3.2.1 Dam and Spillway: Overall, the dam was in fair condition at the time of inspection. A very limited maintenance program exists for this structure. Uncontrolled growth promotes the development of deep rooted vegetation and this type of growth can encourage piping within the embankment. Also, excessive growth inhibits effective visual inspections of the dam. A routine maintenance program should be initiated for this structure. The embankment slopes should be mowed at least once a year, but more preferably twice a year. Trees presently growing on the embankment should be cut to the ground. All trees greater than 3 inches in diameter should have their stumps and root structures removed and resulting holes backfilled with compacted soil and seeded.

The saturated area and iron-stained seepage encountered below the downstream toe are believed to represent water exiting from the rock toe as no toe drain outlet has been provided. The saturated area appears to be rather uniform and no turbidity was noted during the inspection. Flow rates in the iron-stained areas were generally less

than 1 gpm. Although the seepage is not considered critical due to the presence of the rock toe it is recommended that it be monitored quarterly to detect any increase in flow rates which could result in piping within the embankment. If increased flows should occur, which are transporting fines, a Professional Engineer should be contacted to evaluate the problem and make recommendations for required corrective measures. The observed spring is not believed to have any effect on the performance of the dam.

The approach channel, weir, and bridge are in good condition. The concrete discharge channel is in need of repair. The left abutment slope, which bounds the plunge pool area, is severely eroded and continued slope failure is likely, especially during periods of rainfall and high discharge. The erosion is not believed detrimental to the dam as it is in a natural cut slope. However, the slope in this unstable state presents a potential hazard to any persons in the immediate area during a slope failure. Access should be restricted in this area or attempts made to stabilize the slope.

A staff gage should be installed to monitor water levels.

3.2.2 Downstream Area: The homes downstream could be jeopardized by a dam breach during periods of high flows.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Timber Lake is used for recreational purposes. The normal pool elevation is maintained by a weir acting as the principal spillway. During periods of normal flows, water flows through the inlet. If rain forecasts are available, the lake is drawn down several feet prior to any heavy rains.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the Peaks View Corporation. Maintenance consists of inspection, debris removal, mowing of the vegetative cover along the crest, and repair. However, there is no routine maintenance program. The operating appurtenances are reportedly in working order.

4.3 Warning System: No warning system exists.

4.4 Evaluation: Maintenance of the dam is considered inadequate. A routine maintenance program should be established and complete records of maintenance and inspections should be maintained for future reference. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a) How to operate the dam during an emergency.

b) Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: No hydraulic/hydrologic data is available.

5.2 Hydrologic Records: There are no records available.

5.3 Flood Experience: The maximum pool level observed was during 1927, when the water was reportedly within 1 ft± of the crest of the dam.

5.4 Flood Potential: In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region), or fractions thereof. The Probable Maximum Flood (PMF), ½ PMF and 100 year flood hydrographs were developed by the SCS method (Reference 4, Appendix IV). Precipitation amounts for the flood hydrograph of the PMF are taken from the U.S. Weather Bureau Information (Reference 5, Appendix IV). Appropriate adjustments for basin size and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulation: For routing purposes, the pool at the beginning of flood was assumed to be at elevation 814 msl. Reservoir stage-storage data and stage-discharge data were determined from the available plan, field measurement and USGS quadrangle sheets. Floods were routed through the reservoir using the principal spillway discharge up to a pool storage elevation of 820 msl and a combined

spillway and non-overflow section discharge for pool elevations above 820 msl.

5.6 Overtopping Potential: The predicted rise of the reservoir pool and other pertinent data were determined by routing the flood hydrographs through the reservoir as previously described. The results for the flood conditions (PMF and ½ PMF) are shown in the following Table 5.1.

TABLE 5.1 - RESERVOIR PERFORMANCE

		Hydrograph	
	Normal Flow	½ PMF	PMF
Peak Flow, CFS			
Inflow	4	11,458	22,915
Outflow	4	10,967	22,869
Maximum Pool Elevation ft, msl	814	822.80	825.3
Non-Overflow Section (Elev 820 msl)			
Depth of Flow, ft	-	2.8	5.3
Duration, hours	-	5.0	5.0
Velocity, fps (a)	-	7.1	9.8
Spillway (Elev 814 msl)			
Depth of Flow, ft	-	8.8	11.3
Duration, hours	-	30	30
Velocity, fps	-	14	17.3
Tailwater Elevation ft, msl	787	796	802

(a) Critical velocity at control section.

5.7 Reservoir Emptying Potential: A 12 inch diameter pipe at elevation 792 msl is capable of draining the reservoir. Assuming that the lake is at normal pool elevation (814 msl) and there is 4 cfs inflow, it would take approximately 32 days to lower the reservoir to elevation 787 msl. This is equivalent to an approximate drawdown rate of 0.7 ft per day based on the hydraulic height measured from normal pool to drain pipe invert divided by the time to dewater the reservoir.

5.8 Evaluation: The U. S. Army, Corps of Engineers, guidelines indicate the appropriate spillway design flood (SDF) for an intermediate size significant hazard dam is the ½ PMF to PMF. Because of the risk involved, the ½ PMF has been selected as the SDF. The spillway will pass 20 percent of the PMF (40 percent of the SDF). The SDF will overtop the dam a maximum 2.8 ft, and remain above the dam for 5 hours with a critical velocity of 7.1 fps.

Hydrologic data used in the evaluation pertains to present day conditions with no consideration given to future development.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam is located within the Piedmont Physiographic province of Virginia. The impoundment and structure are underlain by the Lynchburg Formation of late Precambrian age. The Lynchburg consists basically of gray quartz and mica bearing schists and gneisses. Graphite schists and hornblende gneisses are also present. Bedrock exposed in the area generally strikes to the northeast and dips 40 to 70 degrees to the southeast. Foliation or "slaty cleavage" measured in the principal spillway channel strikes to the northeast and dips from vertical to 45 degrees to the southeast. Joint sets were also visible in the bedrock, however, no faults were observed at the site.

Subsurface data is not available for the structure. Based upon examination of surrounding hillsides and cuts, it would appear that the dam may rest in part on alluvial soils which probably occur along the old stream channel. These soils likely consist of assorted mixtures of sand, silt, and clay with variable amounts of gravel. Expected natural permeabilities would range from low to high. Residual soils are exposed in the left abutment area. These soils are derived from the in-place weathering of mica schists and gneisses. Where exposed, they consist of micaceous clayey silts (ML to MH), micaceous silts (ML) and micaceous silty sands (SM). Iron staining was noted along relict joint surfaces. The residual soils examined also included intermittent zones of bedrock weathered to various degrees. Natural permeabilities would probably range from low to medium, but high permeabilities are likely along relict joints. Gradual consolidation of underlying soils would be expected during application of fill materials. The underlying soils

probably had essentially fully consolidated under the applied load not long after completion of construction. Based upon the performance history of this dam, a stable foundation is assumed.

6.2 Embankment:

6.2.1 Materials: There is only limited information available on the nature of the embankment materials. The surface of the embankment appears to be constructed with assorted combinations of micaceous sand, silt and clay ranging from SM, ML to MH in composition. Low to high permeabilities are likely for these materials. According to Mr. F. L. Showalter, the dam was constructed completely with "red clay" and includes a concrete core of unknown dimension. The existence of a cutoff could not be confirmed. Fill placement was supervised and the material compacted with mules and "slip scrapers".

6.2.2 Subdrainage and Seepage: A benched 8 ft high toe drain extends approximately 185 ft along the downstream slope (see Sheet 1, Appendix III). The rock toe drain appears to be functioning properly, as no saturated zones or seeps were noted on the downstream embankment above the toe. However, a saturated zone extends to approximately 50 ft beyond the lowest point of the toe drain. This may represent seepage through the foundation, or merely seepage through the rock since no outlet drains were provided.

6.2.3 Stability: There are no stability calculations for this structure. The dam is 33 ft high and has a crest width of 17 ft. The upstream slope is very steep above the normal pool level and includes a 5 to 6 ft high wall above normal pool. The upstream slope is believed to slope approximately 3H:1V below water level. The downstream slope is approximately 2H:1V.

Although the type materials used during construction cannot be confirmed visually, it is believed the structure is a homogeneous dam constructed with CL to MH soils. The dam is subjected to a sudden drawdown because the approximate reservoir drawdown rate of 0.7 ft per day exceeds the critical rate of 0.5 ft per day for earth dams. According to the guidelines present in Design of Small Dams, U.S. Department of the Interior Bureau of Reclamation, for small homogeneous dams with a stable foundation subject to rapid drawdown and composed of CL to MH materials, the recommended slopes are 2.5H:1V for the downstream slope and 3.5 to 4H:1V for the upstream slope. The recommended crest width is 17 ft. Based upon these guidelines, the width is adequate but slopes are inadequate.

6.2.4 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: An accurate check on the stability of this structure cannot be made since there is no design and construction data. Foundation conditions are not known and the embankment slopes do not meet the requirements recommended by the U. S. Bureau of Reclamation for small homogeneous earthfill dams on stable foundation. Therefore, it is recommended that the owner retain the services of a Professional Engineer with expertise in geotechnical analysis to evaluate the stability of the dam. Since no undue settlement, cracking or sloughing was noted at the time of inspection, it appears that the embankment is adequate for maximum

control storage with water at elevation 814 msl. As previously stated, the iron-stained seepage areas and continuous saturated zone observed along the toe of the donstream slope are believed to represent water exiting from the toe drain. However, it is possible that iron-stained areas are the result of seepage through the dam foundation. Therefore, it is recommended that iron-stained areas be monitored quarterly to detect any increase in flow rates, which could result in piping through the dam foundation. If increased flows should occur, a Professional Engineer should be contacted to evaluate the problem and make recommendations for required corrective measures. Also there is overtopping. The SDF will overtop the embankment a maximum 2.8 ft and remain above the dam for 5 hours with a critical velocity of 7.1 fps. Overtopping is considered detrimental because the critical velocity exceeds 6 fps, the effective eroding velocity for a vegetated earth embankment.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The Timber Lake Dam at the time of inspection appeared to be in fair condition. The appropriate SDF for this dam is the ½ PMF. The spillway will pass 20 percent of the PMF (40% of the SDF) without overtopping, and the dam will be overtopped by 2.8 ft during the SDF for a period of 5 hours at a maximum velocity of 7.1 fps. The spillway is judged seriously inadequate.

There are no design or construction records available for this structure, therefore, an accurate check on its stability cannot be made. Flows overtopping the dam are considered detrimental with respect to erosion.

Only a limited maintenance program exists for the structure and maintenance is considered inadequate.

Due to the inadequacy of the spillway, the detrimental effect of the resulting overtopping of the dam during the SDF, and the lack of stability data, the potential for increased hazard to the downstream dwellings exists. Thus, the dam is assessed "unsafe, non-emergency".

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

7.2 Recommended Remedial Measures: It is recommended that within two months of the date of notification of the Governor of the Commonwealth of Virginia, that the Owner engage the services of a professional engineering consultant to complete the following action:

1) A detailed evaluation of the downstream floodplain and of the Spillway Design Flood appropriate to this dam. Remedial measures to be considered include modification to the dam, spillway, floodplain and/or any other method of eliminating the danger imposed by the dam.

2) A subsurface investigation and stability analysis should be performed by a Geotechnical Engineer in order to evaluate the stability of the dam and modify as necessary. The widespread seepage observed along the downstream slope should be assessed in this study.

Within six months of the notification of the Governor, the consultant's report of appropriate remedial mitigating measures should have been completed and the Owner should have an agreement with the Commonwealth of Virginia for a reasonable time frame in which all remedial measures will be complete.

Until corrective measures are completed, the dam should be checked during periods of heavy runoff. If dam overtopping is imminent, warning should be issued to the downstream inhabitants.

In the interim, an emergency operation and warning plan should be promptly developed. It is recommended that a formal emergency procedure be prepared, prominently displayed, and furnished to all operating personnel. This should include:

1) How to operate the dam during an emergency.

2) Who to notify, including public officials, in case evacuation from the downstream area is necessary.

7.3 Required Maintenance and Observation:

7.3.1 The concrete spillway discharge channel should be repaired.

7.3.2 The eroded left abutment slope bounding the plunge pool presents a potentially unsafe condition for any persons in the immediate area. Efforts should be made to either restrict human activity in this area or to stabilize the slope.

7.3.3 Seepage present along the downstream toe should be monitored quarterly and after periods of high pool levels in the reservoir to detect any increased flow rates which may cause piping within the foundation.

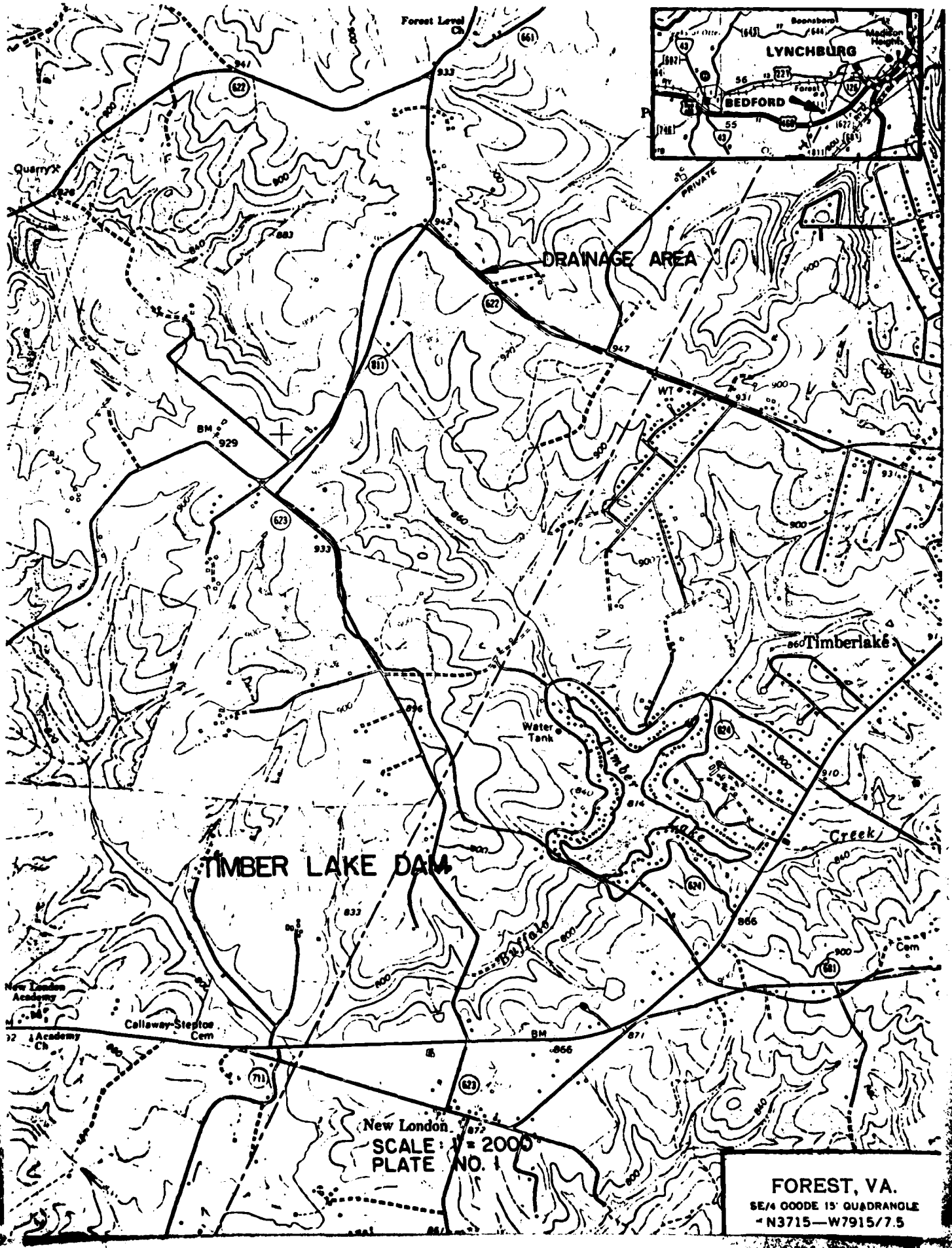
7.3.4 The grass and weeds on the embankment should be cut at least once and preferable twice a year. We would recommend maintenance in the early summer and fall.

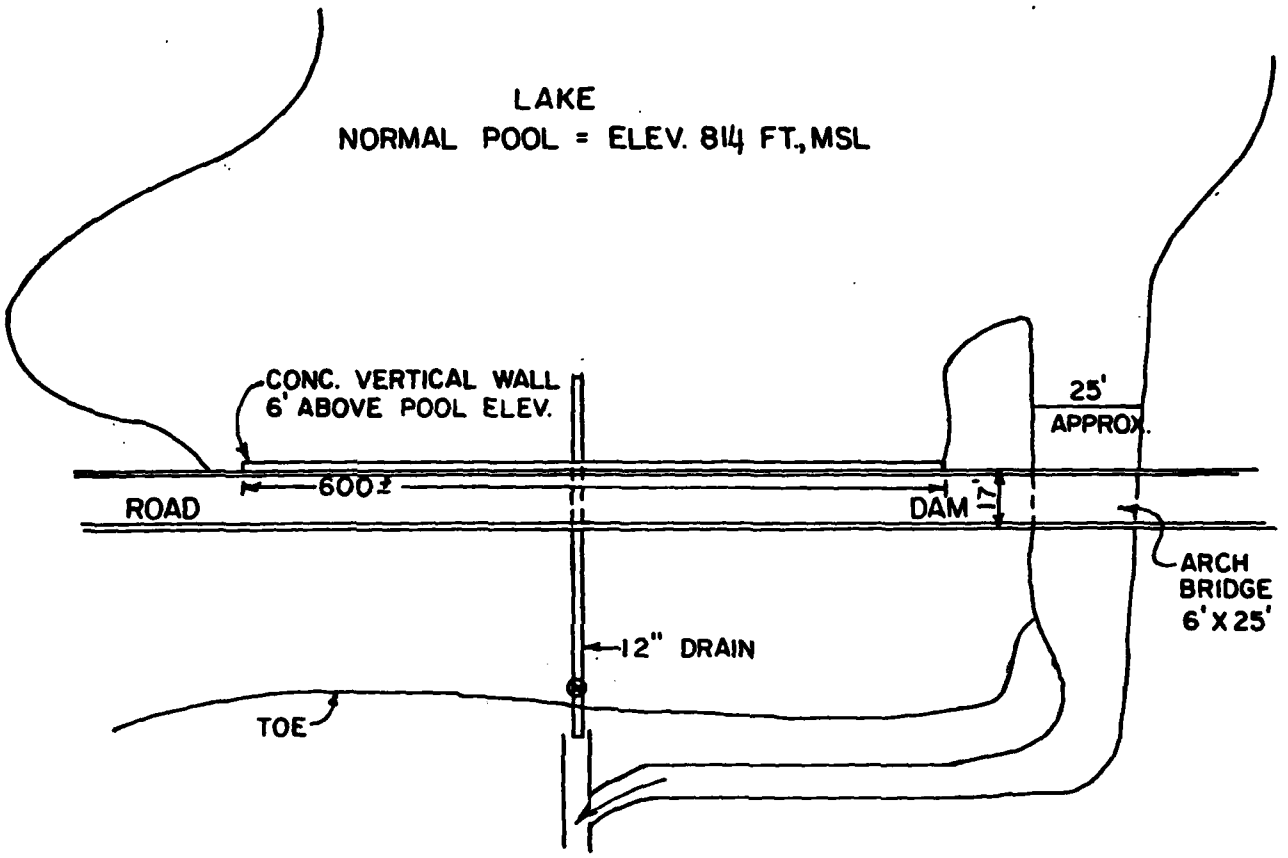
7.3.5 All trees present on the embankment should be cut to ground level yearly during maintenance operations. Trees greater than 3 inches in diameter should have their stumps and root structures removed and resulting holes backfilled with compacted soil and seeded.

7.3.6 A staff gage should be installed to monitor water levels.

APPENDIX I

MAPS AND DRAWINGS


LYNCHBURG
BEDFORD
DRAINAGE AREA
TIMBER LAKE DAM
Timberlake
Water Tank
Timber Lake Creek
Buffalo
Forest Level Ch
Quarry
PRIVATE
WT
BM
929
New London Academy
Academy Ch
Calloway-Steptoe Cem
New London
SCALE: 1" = 2000'
PLATE NO. 1
FOREST, VA.
SE/4 GOODE 15' QUADRANGLE
N3715—W7915/7.5



PLAN

TIMBERLAKE DAM

FIELD SKETCH
PLATE NO. 2

APPENDIX II

PHOTOGRAPHS

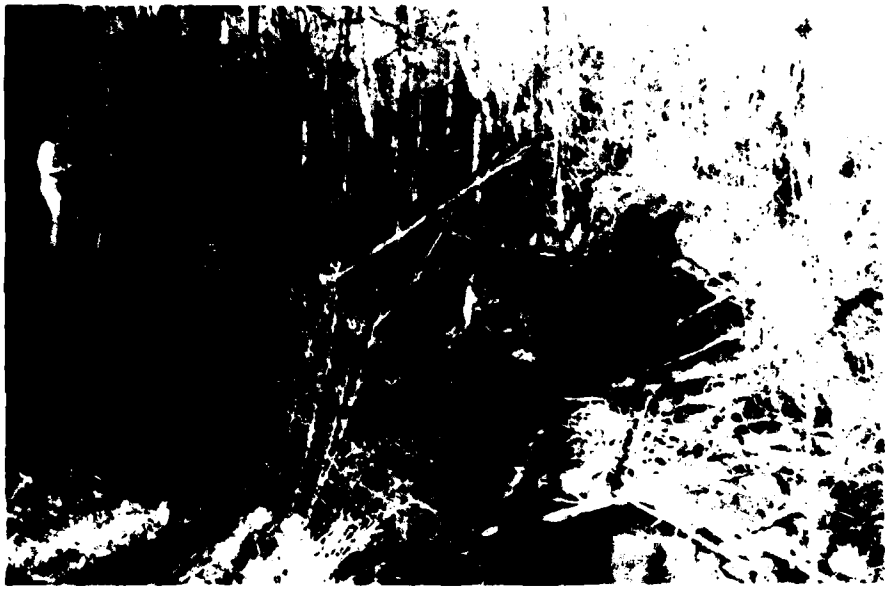
Outlet Channel, Bridge and Spillway

(Note Broken Sections of Channel)

Photograph No. 1

Drain Valve and Outlet

Photograph No. 2



Downstream Channel (Note Debris)

Photograph No. 3

Downstream Face of Dam

Photograph No. 4

Approach Channel to Spillway

Photograph No. 5

Seepage Below Toe Drain

Photograph No. 6

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam Timber Lake County Campbell State Virginia Coordinators Lat 37°-18.8' Long 79°-15.5'

Date(s) Inspection 4/17/80 Weather Clear Temperature 55°F

Pool Elevation at Time of Inspection 814 msl Tailwater at Time of Inspection 787 msl

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Raymond A. DeStephen, P.E.
Stephen G. Werner (recorder)

J. K. Timmons and Associates, Inc.
Robert G. Roop, P.E.
Donald Balzer (recorder)

State Water Control Board
Hugh M. Gildea, P.E.

Owner's Representative
Edwin S. Martin

Peaks View Corporation
John Johnson, Caretaker

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	The slopes, crest, principal spillway and abutment contacts were inspected and no cracks were noted. The embankment slopes and much of the abutment areas were heavily overgrown with trees of various diameter, dense weeds, and brush. Observation was very difficult.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movements or cracking were noted on the dam or downstream beyond the embankment toe.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed. The extremely thick vegetative cover hindered visual inspection. Downstream slope is approximately 2:1above the toe drain. The upstream slope is essentially vertical and includes a 5 to 6 ft high concrete wall.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Appeared to be good. A 15 ft$\pm$ wide paved road occupies the crest of the dam.	
RIPRAP FAILURES	Riprap was observed below pool level along the toe of the concrete wall. Riprap is also present in plunge pool at the outlet works.	Good condition.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The right abutment is heavily overgrown with vegetation, making observation difficult. Gra to brown highly weathered to decomposed mica schist is exposed in the severely eroded principal spillway outfall channel. A vertical drop of 25 ft exists at the left abutment and principal spillway outfall contact as a result of erosion. Foliation strikes N68E and dips variably from 90° to 45°± SE. Joint sets were also present in the rock, N20W, 79SW ar N50W, 90 to 60°SW. Approximately 30 ft of residual soils were exposed above the bedrock. These soils were highly micaceous, visually classifying as SM, ML and MH. No faults were observed.	
ANY NOTICEABLE SEEPAGE	Scattered seepage areas were located below the toe drain, along the downstream slope. The seepage was iron-stained and was seeping at a rate of no more than 1 gpm. The ground surfa below the toe drain was generally saturated to a point 50 ft below the drain. It would appear that the toe drain is functioning properly. A small spring was observed along the right side of the drain outfall channel, 10 ft from the end of the pipe. Flow was estimate at 5 gpm. See accompanying field sketch, Sheet 1.	
STAFF GAGE AND RECORDER	None	
DRAINS	Rock toe drain present along the downstream slope. See field sketch, Sheet 2.	

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Channel is 25 ft wide. The trash rack is operable. The left side of the above bridge shows strong seepage.	Good condition. Seepage is possib a spring. Dye testing by owner could not determine the origin of the seepage.
APPROACH CHANNEL	Concrete bottom, stone lined. Appears to be silted.	Good condition.
DISCHARGE CHANNEL	Discharge channel is concrete, approximately 25 ft wide. Channel is eroded and broken approximately 30 ft downstream of bridge and water falls approximately 20 to 25 ft. Broken end of channel is cracked allowing further deterioration and plunge pool area is badly cracked.	Needs repair.
BRIDGE AND PIERS	Concrete arch bridge 25 ft x 6 ft high crosses the weir.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None	-
INTAKE STRUCTURE	None	-
OUTLET STRUCTURE	None	-
OUTLET CHANNEL	None	-
EMERGENCY DRAINS	12" valve drain, 12" drop inlet. Riprap at plunge pool.	Minor erosion at plunge pool.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Grass lawns with 20:1 slopes bound the reservoir. A stone bulkhead occurs along the perimeter.	-
SEDIMENTATION	The water is murky and sediment buildup is suspected.	-

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Trees and debris occur throughout the channel. N = 0.1; 300 ft± wide flood plain. Heavily vegetated and swampy. Side slopes = 3:1.	-
SLOPES	Vertical with sloughing. Roots are exposed and severe erosion was observed, 6 ft deep, 15 ft wide.	-
APPROXIMATE NO. OF HOMES AND POPULATION	Several homes approximately ½ to 1 mile downstream on fringes of floodplain, 15 ft± above the stream.	

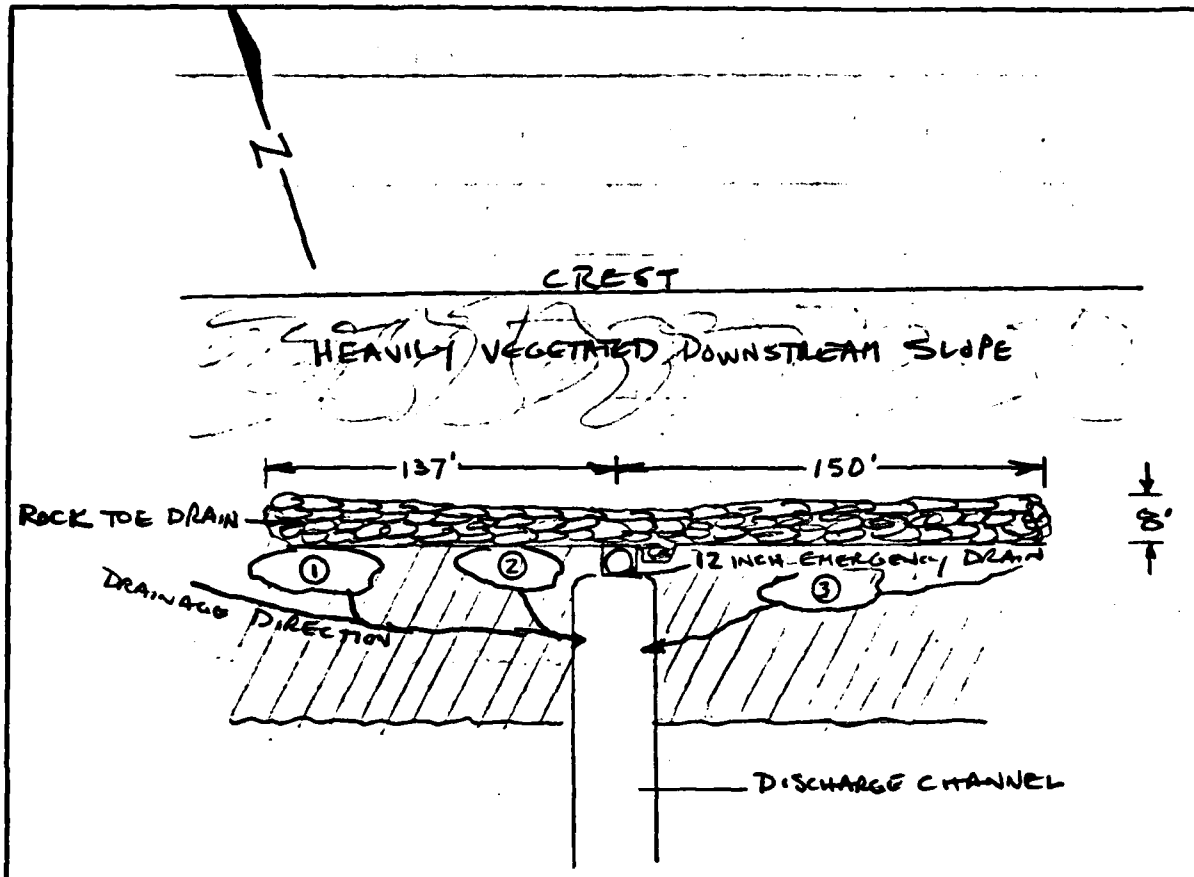
INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	-
OBSERVATION WELLS	None	-
WEIRS	None	-
PIEZOMETERS	None	-
OTHER		

BY SW DATE 5/17/80 **SCHNABEL ENGINEERING ASSOCIATES** SHEET NO. 1 OF 2

CHKD. BY ..... DATE ..... **CONSULTING ENGINEERS** JOB NO. V80107

SUBJECT FIELD SKETCH - DOWNSTREAM SLOPE



NO SCALE

① WET AREA

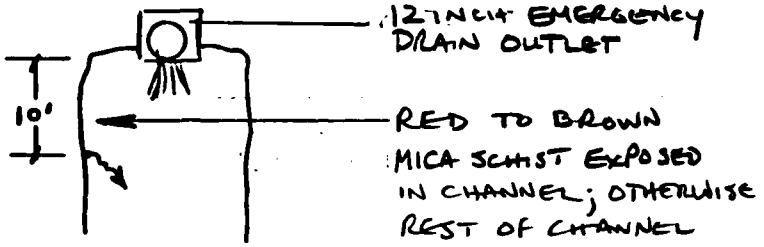
② SEEPAGE AT LESS THAN 1 GPM; IRON STAINING; 40'x20'

③ SEEPAGE AT LESS THAN 1 GPM; IRON STAINING

▨ SATURATED GROUND; GENERALLY EXTENDS 50 FT ± BELOW TOE OF DRAIN; CONSIDERABLY MORE MOISTURE ON RIGHT SIDE OF OUTLET PIPE.

BY SW DATE 5/17/88 **SCHNABEL ENGINEERING ASSOCIATES** SHEET NO. 2 OF 2
CHKD. BY ..... DATE ..... **CONSULTING ENGINEERS** JOB NO. V8Q107
SUBJECT FIELD SKETCHES — TIMBER LAKE

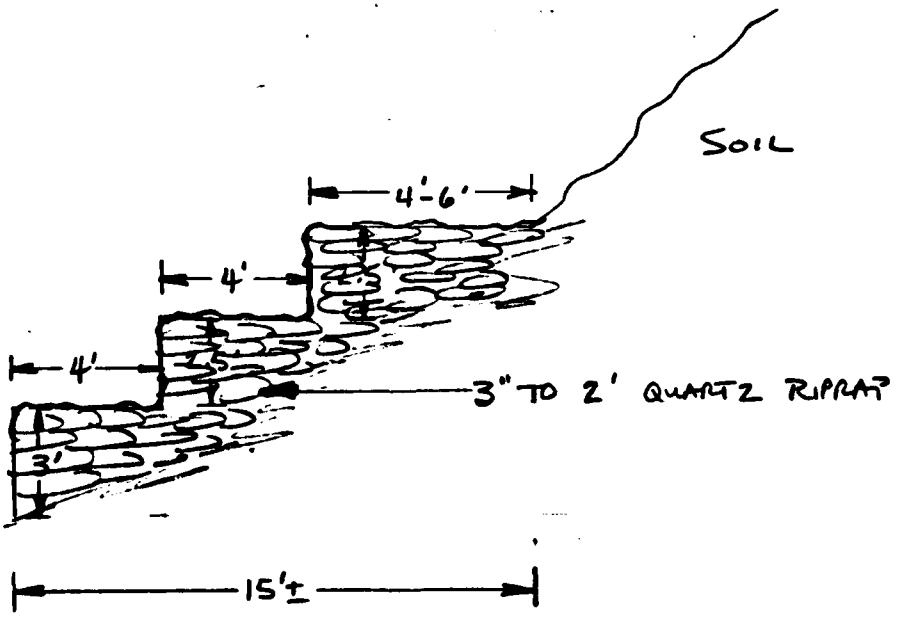
SPRING LOCATION



→ SPRING FLOWING AT 5 GPM ±. MR JOHNSON STATED THAT IT HAD BEEN THERE FOR AT LEAST 20 YRS

NO SCALE

ROCK TOE DRAIN
50 FT ± LEFT OF OUTLET



APPENDIX IV - REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.
2. Design of Small Dams, U. S. Department of Interior, Bureau of Reclamation, 1974, 816 pp.
3. Geology and Mineral Resources of the Lynchburg Quadrangle, Virginia, Bulletin 74, William R. Brown, Virginia Division of Mineral Resources, 1958, 99 pp.
4. Section 4, Hydrology, Part 1 Watershed Planning, SCS National Engineering Handbook, Soil Conservation Service, U. S. Department of Agriculture, 1964.
5. Hydrometerological Report No. 33, U. S. Department of Commerce, Weather Bureau, U. S. Department of Army, Corps of Engineers, Washington, D. C., April 1956.